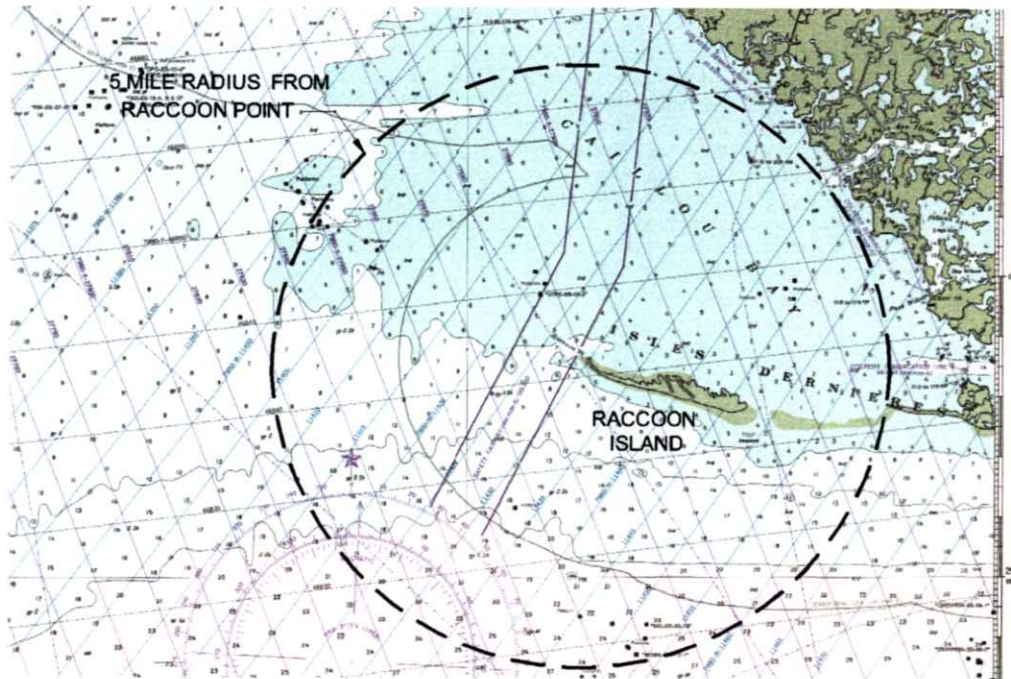


OFFSHORE GEOPHYSICAL AND PRELIMINARY
GEOTECHNICAL SURVEY REPORT
JULY 15, 2005

PREPARED FOR:



PREPARED BY:



Alpine Ocean Seismic Survey

OFFSHORE GEOPHYSICAL AND
PRELIMINARY GEOTECHNICAL SURVEY REPORT

RACCOON ISLAND SHORELINE PROTECTION/
MARSH CREATION PROJECT (TE-48)
LDNR CONTRACT NO. 2503-05-47

EXECUTIVE SUMMARY

A geophysical survey, consisting of subbottom and bathymetric profiling, along with magnetometer surveying, has been conducted in the area offshore of the south coast of Raccoon Island, Terrebonne Parish, Louisiana. A total of approximately 100 nautical miles of geophysical survey were run during the project.

The geophysical survey was conducted in two parts, the first being a regional survey. This survey confirmed the presence of two buried channels within the surveyed area. A primary channel was surveyed from a point approximately six miles offshore of Raccoon Island for at least 20,000 feet in a northwesterly direction. A detailed survey was conducted to outline the channel, with lines conducted at 500-foot intervals perpendicular to the channel orientation. The channel sediments are between 15 and 25 feet thick and between 500 and 750 feet in width. Magnetometer surveys within the detailed area did not detect any significant features, finding only limited amounts of metallic debris.

Preliminary sediment sampling has been conducted at locations along the channel where the geophysical data indicated the potential for coarser sediments to be found. Based upon visual observations, the sediments recovered in the cores ranged from highly cohesive clay to coarse silt/very fine sand.

A second potential channel feature has been outlined with survey lines conducted at 1,500 foot intervals. This channel has not been sampled, but may contain silty sediments.

A detailed geotechnical plan consisting of additional sediment sampling using coring equipment capable of penetrating and recovering samples to 20 feet below the sea floor within the buried channels is recommended to determine the sediment characteristics.

If coarser sediments than those found during the field work investigation are desired for project construction, additional geophysical surveys outside of the study area are recommended.

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1.0 INTRODUCTION

A geophysical and preliminary geotechnical survey consisting of seismic subbottom profiling, echo sounding, magnetometer profiling and preliminary core sampling and sediment sample description was performed by Alpine Ocean Seismic Survey, Inc. (Alpine) and Coastal Engineering Consultants (CEC), under a Sub-Consultant Agreement with SJB Group, Inc., for the Louisiana Department of Natural Resources, DNR Contract No. 2503-05-47, Raccoon Island Shoreline Protection / Marsh Creation Project (TE-48).

The objective of this Project is to protect and preserve the structural integrity of the barrier shoreline along the Gulf of Mexico. The Project, as planned, would include the design and construction of a sand dike with subsequent filling of the area within the dike to make a marsh platform. The extent and exact locations of the dike and platform are still under discussion by the various parties.

The purpose of this survey is to locate potential offshore borrow areas which can be used as sources for sediments useful as marsh fill and dike construction on Raccoon Island, evaluate the potential sources, determine the suitability and thickness of the sediments, and evaluate quantities. Additional purposes include identifying any pipelines or other obstructions by remote sensing (magnetometer) that might impact usage of the intended borrow areas.

2.0 GEOLOGIC SETTING

The general study area, shown in Figure 1, is located offshore and within a five-mile radius of Raccoon Island, seaward of the approximate depth of closure. This island forms the westernmost point in the Isles Dernieres barrier island chain located offshore of Terrebonne Parish, on the east central Louisiana Gulf shoreline. The Isles Dernieres represent the remains of a former Mississippi River delta, with the sand present in the islands rolling inland with rising sea level. During the transgression of the sea over the former land surface, small distributary channels, and other similar stream channels that had been present on the land surface, were abandoned. These streams were areas of higher velocity water movement, which served to winnow out the fine grained sediments, sometimes leaving evidence, in the form of crossbedded stratigraphy, coarser sediment deposits.

The sedimentary layering present outside of these channel deposits is generally flat-lying, which is indicative of an environment where fine grain sediment, such as clays and fine silts, would be deposited. Therefore, a search for potential coarser sediment deposits would concentrate on linear features with crossbedding present.

3.0 PREVIOUS SURVEYS

As presented in the Initial Work Plan (SJB et al., 2005), the two potential survey areas, Area 12 and Area 17, were based on a report by Suter, et al, 1991, "Nearshore Sand Resources of the Mississippi River Delta Plain: Marsh Island to Sandy Point", submitted to the Louisiana Geological Survey. The report included the results of geophysical profiling and Vibracore sampling, which identified two buried channels, one in each of the two proposed survey areas. However, the report did not contain adequate data to map the extent of either of the channels.

The geophysical data collected by Suter et al., for the eastern area (Area 17) showed a buried channel with crossbedded layering in the upper half of the channel. A core taken through the channel by Vibracore was analyzed by Suter et al. for grain size and reported to contain interbedded very fine sand and clay in the upper feet, underlain by clay. This upper fine sand and clay unit was identified by SJB and CEC during the summary of data for this project, as being potentially suitable for use in project construction.

4.0 SURVEY PLAN

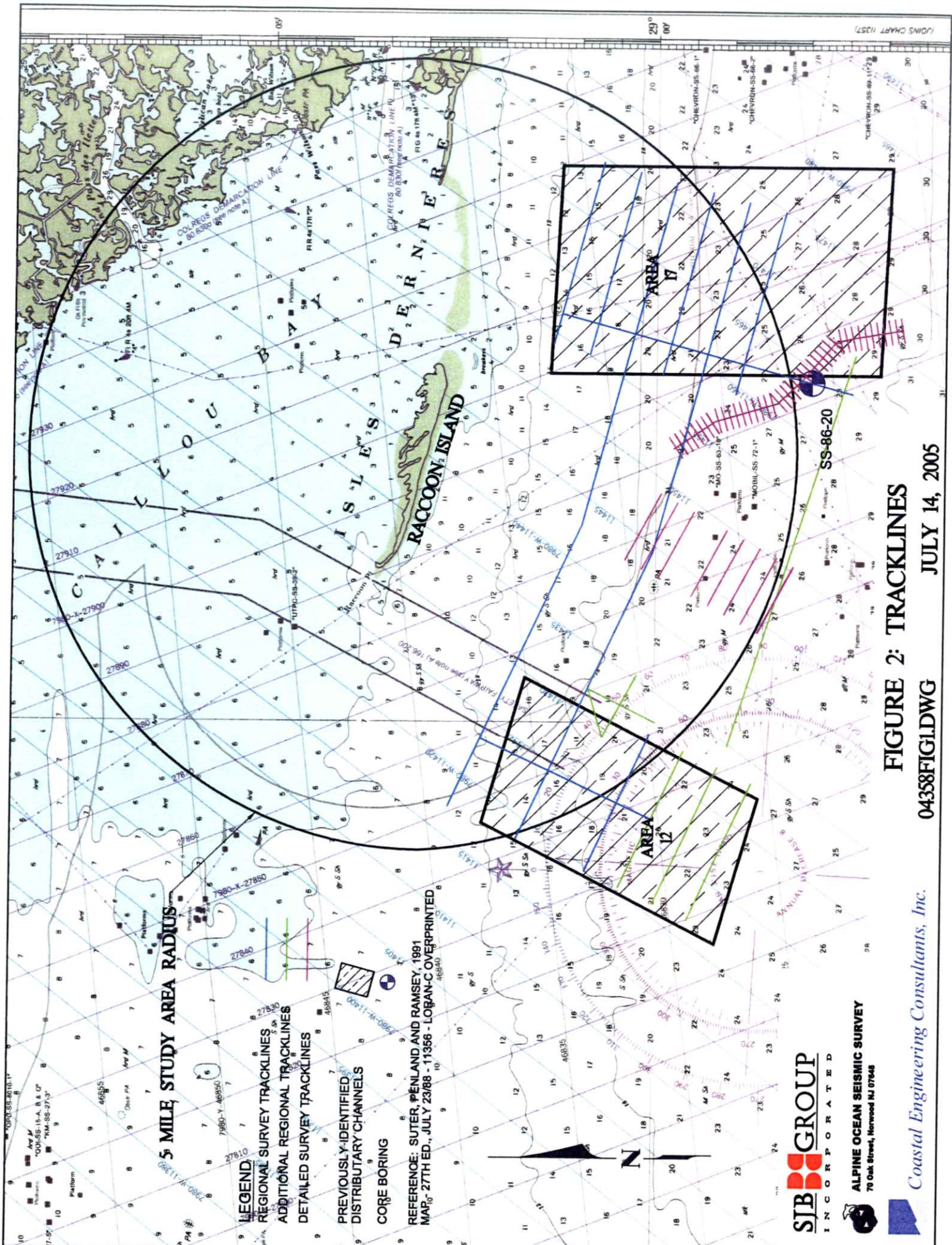
4.1 Regional Geophysical Survey

As shown in Figure 2, sets of parallel lines, aligned parallel to the coastline, were proposed for the eastern area, (Area 17), with line spacing of 3,000 feet, and for the western area (Area 12), with the line spacing of 6,000 feet. Additional lines were proposed between the two areas as continuations of two of the lines in the east and west areas. In addition, one crossline, oriented perpendicular to the initial survey lines, was proposed in the eastern area, passing through the location of a core sample reported by Suter et al. to contain sand.

This set of lines (approximately 40 nautical miles) comprised the regional geophysical survey to attempt to identify locations and extents of any buried channels. Once in the field, further lines were added for the purpose of providing full coverage of the study area. Three additional lines were added to the offshore side of the western area, an additional line oriented in a cross pattern was added to eastern side of the western area, and a third line was run between the eastern and western areas, connecting the offshore sides of these two areas.

4.2 Detailed Geophysical Survey

During the conduct of the proposed survey lines, the channel reported by Suter et al. to be located in the eastern area was detected on the regional geophysical survey records. Four lines in a square pattern, 2000 feet on a side, were run throughout the vicinity where this



5 MILE STUDY AREA RADIUS

LEGEND
 REGIONAL SURVEY TRACKLINES
 ADDITIONAL REGIONAL TRACKLINES
 DETAILED SURVEY TRACKLINES

PREVIOUSLY IDENTIFIED
 DISTRIBUTARY CHANNELS
 CORE BORING

REFERENCE: SUTER, PENLAND AND RAMSEY, 1991
 MAP, 27TH ED., JULY 23/88 - LOGAN-C OVERPRINTED

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Coastal Engineering Consultants, Inc.

FIGURE 2: TRACKLINES

04358FIG1.DWG

JULY 14, 2005

primary channel was initially crossed, and the channel orientation was determined to be northwest-southeast at that location. A long line was then run to the northwest from that area, passing in and out of the channel in order to determine the approximate location and extent of the channel. Subsequently, several lines were run perpendicular to the channel alignment at 1500 foot line spacing in order to better map the channel in the vicinity of the core sample reported by Suter et al.

Finally, a series of lines, spaced at 500 feet, were run across the channel, starting about 5 miles offshore of Raccoon Island and continuing to the northwest for a distance of 20,000 feet. In addition, a secondary channel-like feature detected on two of the long mid sections lines, was investigated with a series of short survey lines, spaced at 1500 feet.

5.0. SURVEY EQUIPMENT

5.1 Survey Vessel

The motor vessel Miss Ola, a 23-foot aluminum boat with twin outboard engines and an enclosed cabin area, was used to conduct the survey. This vessel was used because of its high speed capability to reach the work site from the nearest suitable land base. A layout of the vessel is shown in Figure 3.

5.2 Navigation Equipment

Accurate positioning for the survey was accomplished with a Trimble 4000 GPS receiver and a Starlink Differential system which automatically detects and locks to the nearest US Coast Guard differential correction signal. The pre-plotted lines were displayed on the computer along with the position of the survey vessel, allowing the helmsman to steer the vessel along the pre-plotted lines. Navigation fix marks were recorded at 200- foot intervals along all survey lines.

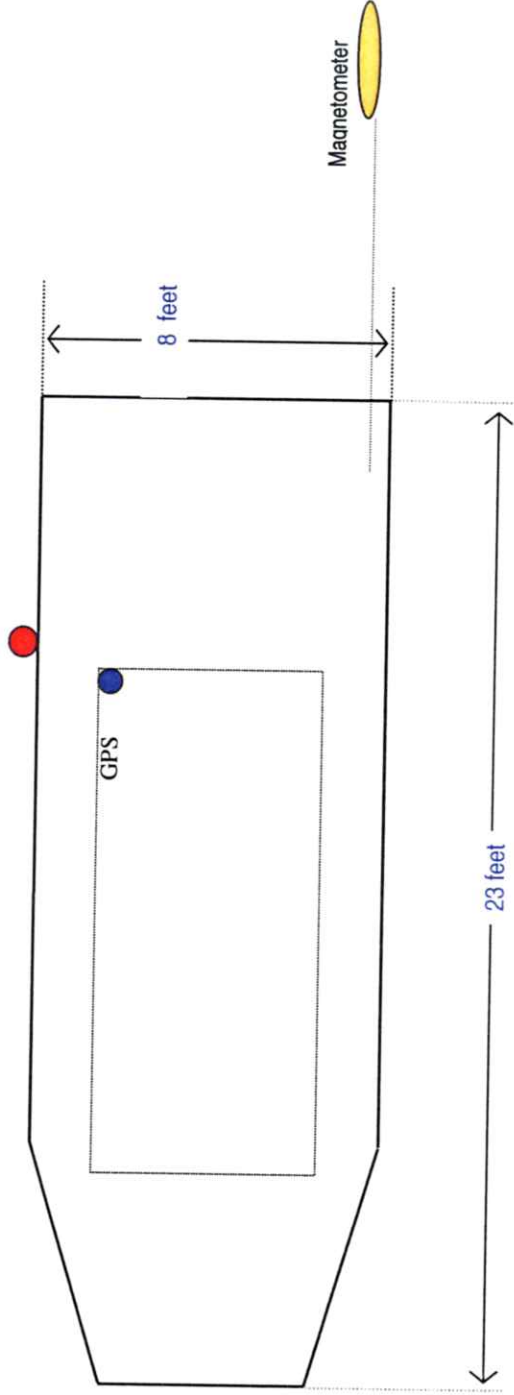
5.3 Echo Sounder

An Innerspace Model 456 Digital Echo sounder, operating at 200 KHz with a 9 degree transducer, was used to collect water depths along the survey lines. Water depths were transmitted to and stored in the navigation computer along all survey lines. This echo sounder has a video display of the sea floor, along with navigation fixes. The video display is captured electronically and these screen images can be played back and displayed for reference if required.

5.4 Tide Gauge

A Coastal Oceanographics digital tide gauge recorder was installed on a pipe offshore of Raccoon Island during the mobilization for the geophysical survey. A tide staff marked in 0.1 foot intervals was mounted on a steel pipe at the location of the gauge. The tide staff was leveled in to NAVD 88 datum using an RTK surveying system and referenced to benchmark TE48-SM-01 "COON". The benchmark was established as part of LDNR's Secondary GPS Network. The horizontal position is at N 201,740.57 and E 3,408,702.09 NAD 83 LSZ(1702) feet and the elevation is 2.46 feet NAVD 88. The data from the digital gauge were downloaded at the end of the survey, corrected to the datum, and used to correct the raw digital water depths.

SBP and ES
Transducers



Device	Offset Y	Offset X	Depth
Echosounder (ES)	-3 feet	2 feet	2.6 feet
Subbottom Profiler (SBP)	-3 feet	2 feet	2.6 feet
GPS Antenna (GPS)	0.0 feet	0.0 feet	
Magnetometer	-6 feet (+ cable out)	-4 feet	Variable

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Miss Ola Offset Layout (Not to Scale)

Figure 3

Coastal Engineering Consultants, Inc.

5.5 Subbottom Profiler

A DataSonics CAP 6600 CHIRP system was used to conduct the geophysical survey. The signal was transmitted and received through a set of four transducers set in a gimbed over-the-side mount. The data were stored in the system while being displayed on a video monitor and recorded with an Alden Model 9825 strip chart recorder. The navigation fix marks, along with the X-Y location and time and date of each fix, as received from the navigation computer, were stored in the DataSonics system and recorded on the Alden.

A TSS DMS2-05 heave compensator was used to improve the quality of the data by reducing the effect of waves on the data.

The system was set to operate at the following parameters:

- Source level 2KW max, operated at 6 db reduction from maximum power
- Transmitting Repetition Rate, 0.125 seconds
- Transmitting Pulse Length -5 milliseconds
- Operating frequency 2-7 KHz, swept range
- Source Tow depth 2.5 feet
- Recorder sweep - 40 milliseconds display

5.5 Magnetometer

A Geometrics model G-882 Cesium Magnetometer was used to collect total magnetic field signals at one second intervals along the detailed geophysical survey lines. The unit was towed behind the survey vessel at a 50-foot layback. Data were visually displayed on a laptop computer to monitor for anomalies, and total field data were stored in the Hypack software for later post-processing. The system included a power supply and deck communications unit and computer software.

5.6 Shallow Core Sampler

A 12-foot, 2 1/2-inch diameter, galvanized core pipe was used to collect five core samples within the primary channel. The system uses a gasoline-powered motor on deck to drive a high frequency vibrator attached to the top of the core pipe with a flexible cable. A diver held the core pipe upright on the sea floor during the coring operations. Once the corer had reached full penetration, the core pipe was pulled from the sea floor, capped, and returned to the deck of the survey vessel. The samples were extruded on deck, described and photographed. Representative sediment samples were removed from each core, then bagged, labeled, and stored.

6.0 SCHEDULE OF OPERATIONS

Mobilization of the men, equipment, and vessel to the site was conducted on June 13. The tide staff was installed on June 14. The geophysical equipment was installed on the survey vessel on June 15. Seismic data collection for the regional survey was conducted between June 16 and June 18. Additional limited data collection and sediment sampling was conducted between June 19 and 23, in order to determine the approximate location of the primary buried channel and to collect core samples in the crossbedded unit within, that channel. After coordination with LDNR, the detailed channel surveys were conducted on June 23 and 24. The men, equipment, and vessel were demobilized on the evening of June 25, 2005.

7.0 GEOPHYSICAL DATA REDUCTION

Initial interpretation of the geophysical data was conducted in the field by the Alpine geophysicist. This initial field interpretation was used to determine the locations of the detailed survey track lines. The geophysical data are presented on the Preliminary Survey Plans in Appendix A.

The water depths in the areas of the detailed surveys were corrected using the data from the tide gauge. The water depths are plotted as spot elevations or contours on the Preliminary Survey Plans.

The magnetometer data collected during the detailed survey was reviewed for significant anomalies. No linear targets, such as pipelines or other related oilfield structures, were noted on the records. Only scattered point type anomalies, generally of relatively small magnitude, were noted. Plots of the magnetic data profile from typical detailed lines are presented in Appendix B.

The paper records for the subbottom profile lines run during the detailed survey were scanned and stored. These scanned images were then annotated to show the outline of the primary channel, and, where present, the thickness of the overburden sediments. Each figure shows the annotated section on the bottom and the original section on top. Representative sections are presented in Appendix C.

The location of the channel was then plotted on the navigation data using a bar drawn along each survey line. Figure A-2 (Appendix A) shows the location of the primary channel. The figure also shows the locations of the preliminary sediment cores collected in the detailed survey area.

The same procedure was used to annotate the geophysical data at the secondary channel feature, located between the two original regional survey blocks. (Figure A-3 Appendix A). No core samples were collected in this section as this channel was found by running regional track lines that were additional to those originally planned and the proposed survey time frame and budget was exceeded.

8.0 DATA PRESENTATION

8.1 Geophysical Data

Presented in Appendix A are two maps for each of the blocks of detailed survey lines. The first shows the navigation fixes along the various lines and the core sample locations. The second shows the water depths in the surveyed area, and also shows the location of the primary channel, depicted as a bar along each track line. The width of the main part of the primary channel, as shown on the maps, varies from between 500 and 750 feet. The thickness of the crossbedded unit varies from about 15 feet to about 25 feet, using an assumed speed of sound in sediments of 5,400 feet/second. The length of the portion of the channel that was covered by the detailed survey was about 20,000 feet. Based on visual observations, there is a layer of slightly cohesive clay with some shells present above the northern portions of the eastern buried channel. The bottom of this unit is marked on the interpreted cross sections, and the thickness of the unit is approximately 10 feet at the northern cross section of the eastern detailed survey.

The secondary "channel" feature outlined on the seismic sections collected across the middle of the survey area is not as well defined as that in the primary channel. Generally, the "channel" is defined by a change from the thinly bedded horizontal reflectors present outside of the "channel." In the southern portions of this feature, there is a "bright" spot on the data, possibly indicating a uniform sediment layer. In the northern portions, there appears to be some crossbedding in the deposit, similar to that in primary channel, but not as pronounced.

8.2 Magnetometer Data

Pertinent sections of the magnetometer data have been reproduced as a series of figures (Appendix B) showing the anomalies. The data are summarized in Table 1.

Table 1
Magnetic Anomaly Values and Location

Anomaly No.	Line Number	Navigation Fix	Type	Amplitude, nT
1	18+000	2541.8	DP	10
2	16+000	2587.7	+MP	60
3	12+000	2683.9	+MP	45
4	11+500	2692.1	DP	450
5	5+500	2824.3	DP	130
6	A	2692.9	+MP	60
7	B	2697.8	+MP	60
8	C	2984.5	-MP	130

Legend as to type of anomaly:

- +MP - positive monopole
- MP - negative monopole
- DP - Dipole

9.0 DATA DISCUSSION

9.1 Bathymetry

The water depths within the eastern detailed survey area indicate a relatively flat seafloor gently dipping to the south. The water depths in the area of concern range from approximately 22.5 to 31 feet, (NAVD 88). The water depths in the detailed survey conducted in the middle of the survey blocks ranged from approximately 21.5 to 28 feet, (NAVD 88).

9.2 Magnetometer Data

No significant magnetic features were found adjacent to the channels during the detailed geophysical survey. One line in the middle survey has evidence of two targets, one close and one at a significant distance, as shown by the width of the anomaly. The source of this larger target is not known. All other targets found in the survey are interpreted as being localized magnetic debris.

Two oil platforms were encountered along regional geophysical survey lines, one in the eastern survey and the other in the middle survey. In the eastern survey area the platform encountered is located between navigation fixes 363 and 364. This platform is over a mile away from the primary channel. In the middle survey area the platform encountered is located between navigation fixes 2285 and 2286. This platform is approximately 1400 ft from the secondary channel near Line A.

9.3 Subbottom Data

The geophysical data collected during this survey showed no evidence of blanking due to the presence of gas bubbles within the sediments. The majority of the data is very similar in sediment layering pattern, with a basal reflector present at less than 30 feet below the sea floor, and a series of close spaced generally horizontal layers above that base. The basal reflector is interpreted as being a previous land surface, with the layering above representing subsequent deposition, perhaps from a delta formation of the Mississippi. That surface was then subsequently eroded by the channel formed in the eastern survey area.

The primary channel is somewhat sinuous, as shown by the seismic sections. In the southern part of the channel, the cross bedded layers have slopes to the west, while to the north starting around section 12+000, the bedding dips to the east. The crossbedded units were taken in the field as indicating the most likely locations for coarser sediments to be found. Two preliminary core samples were taken to confirm this interpretation. The first core was taken within the crossbedded unit, and that sample was found to consist of interbedded layers of coarse silt and highly cohesive clay, each several inches thick. The second core was taken in a portion of the channel with slightly flatter layers, and that core contained less cohesive sediments with smaller percentages of silt. This layering tended to confirm the initial interpretation of the crossbedding. However, additional sampling and laboratory analysis will be required to determine if the average grain size of the sediments within the crossbedded units is coarse enough to warrant use on the project.

A total of five cores were taken as shown on the Preliminary Survey Plans (Appendix A). The core field logs, photographs and descriptions are presented in Appendix D.

The nature of the sediments within the secondary “channel” feature in the middle of the survey area cannot be estimated based on the available data. This deposit is considered as secondary to the primary channel. However, in the event that additional sampling is conducted for the project, some cores could be located within this area. Given that the thickness of the overburden layer increases to the north, the samples should be located in the southern portion of the feature within the two sections where the geophysical data indicate a bright spot on the data.

10.0 RECOMMENDATIONS

Based upon the review of the detailed geophysical survey and preliminary sediment sampling results, there is indication that the two buried channels identified within the eastern and middle survey areas may contain deposits of very fine sand/coarse silt that has the potential to be used for the project construction.

A detailed geotechnical sampling plan (Figure 4) is proposed for these two channel features to determine the sediment characteristics within the buried channels. Approximately 12 vibracores, spaced 2000 feet on average, are proposed for the primary channel and approximately 4 vibracores, spaced 2000 feet on average, are proposed for the secondary channel, using coring equipment capable of penetrating and recovering samples to 20 feet below the sea floor.

If coarser sediments than those found during the field work investigation and described on the core logs in Appendix D are desired for project construction, it is recommended that additional geophysical surveys be conducted outside of the study area covered in this search prior to performing a detailed geotechnical investigation.

11.0 REFERENCES

- SJB Group, Inc. and Coastal Engineering Consultants, Inc. 2005. “Summary Report of Literature Search.” Report Submitted to Louisiana Department of Natural Resources, Coastal Resources Division, Baton Rouge, Louisiana.
- Suter, J. R., Penland, S., and Ramsey, K. E. 1991. “Nearshore Sand Resources of the Mississippi River Delta Plain: Marsh Island to Sandy Point.” Report Submitted to Louisiana Geological Survey, Baton Rouge, Louisiana.

